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Multiple-Station Range Target System Operations Manual, Annex 2: Flying Target System Operations and Maintenance Reference Manual

September 1992

Fort Bliss Field Unit
Training Systems Research Division

U.S. Army Research Institute for the Behavioral and Social Sciences

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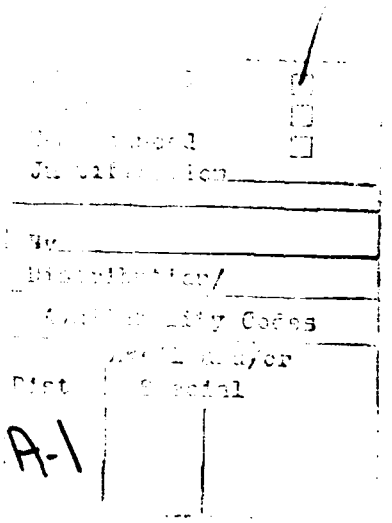

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13. ABSTRACT *(Maximum 200 words)*

The Multiple-Station Range Target System (RTS) is a high-fidelity engagement simulator. Using RTS, Short Range Air Defense (SHORAD) and Forward Area Air Defense System (FAADS) crews employ their actual weapons in simulated or live-fire engagement of subscale, fixed-wing and rotary-wing aircraft. RTS permits training and evaluation of individuals, crews, and platoons; provides detailed crew performance scoring and feedback; and can be moved from one location to another and rapidly deployed for a new training exercise or test application.

This reference manual describes the Flying Target System (FTS) component of RTS. All relevant operations and maintenance procedures are discussed, and a detailed description of the major components of the Flying Target System (aircraft, aircraft communications, voice communications, mobile launcher, and ground support equipment) and a complete listing of needed tools and spare parts is provided. This FTS reference manual is Annex 2 to the separately published Multiple-Station Range Target System Operations Manual.

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Multiple-Station Range Target System Operations Manual, Annex 2: Flying Target System Operations and Maintenance Reference Manual

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Human Factors in Training and Operational Effectiveness

FOREWORD

The Soldier-System Effectiveness Team of the Fort Bliss Field Unit of the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) performs research and development in human performance issues relevant to improving Army Air Defense effectiveness.

Currently, the team is completing a research task entitled "Forward Area Air Defense (FAAD) Performance During Engagement Operations in a Chemical Environment." The research is funded by the Physiological and Psychological Effects of the Nuclear, Biological, and Chemical Environment and Sustained Operations on Systems in Combat (P^2NBC^2) Office, U.S. Army Chemical School, Fort McClellan. The proponent agency for this research is the Directorate of Combat Developments at the U.S. Army Air Defense Artillery School (USAADASCH) at Fort Bliss. A Memorandum of Agreement covering this research project was signed on 7 November 1991 by USAADASCH and ARI.

The research program uses the Multiple-Station Range Target System (RTS) as a testbed. The Multiple-Station RTS is a cost-effective modification of the RTS described in ARI Research Products 91-01, 91-02, and 91-03. Short Range Air Defense (SHORAD) and Forward Area Air Defense System (FAADS) crews employ their actual weapons or training devices in simulated or live-fire engagement of subscale, fixed-wing and rotary-wing aircraft in the RTS high-fidelity engagement simulator.

This Research Product is an operations and maintenance reference manual for the Flying Target System (FTS) component of RTS.

EDGAR M. JOHNSON
Technical Director

MULTIPLE-STATION RANGE TARGET SYSTEM OPERATIONS MANUAL, ANNEX 2:
FLYING TARGET SYSTEM OPERATIONS AND MAINTENANCE REFERENCE MANUAL

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MULTIPLE-STATION RANGE TARGET SYSTEM OPERATIONS MANUAL, ANNEX 2: FLYING TARGET SYSTEM OPERATIONS AND MAINTENANCE REFERENCE MANUAL

1.0 Introduction

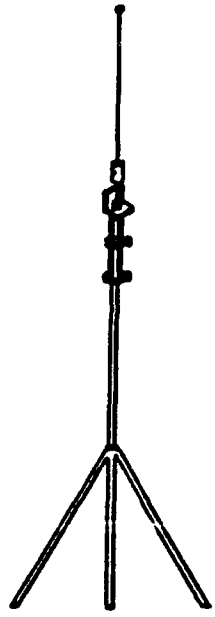
The Flying Target System (FTS) is a subcomponent of the Range Target System (RTS), which is a high-fidelity Air Defense Artillery (ADA) testbed and trainer. This manual provides guidance for personnel responsible for the operation and maintenance of the scaled aerial targets, support equipment, and required auxiliary equipment. Instructions for the initial acceptance and inspection of the entire FTS package are provided. Also included are instructions for equipment set-up, check-out, and operation, as well as appropriate voice commands for controlling and directing scaled aircraft in flight. The major components of the FTS are depicted in Figure 1.0-1.

It is recommended that FTS operations and maintenance personnel be familiar with Army Technical Manual TM9-1550-417-14&P, Radio Controlled Miniature Aerial Target (RCMAT) Operations and Maintenance Manual (Department of the Army Headquarters, 1986). Note, however, that this manual is not directly applicable to the RTS system and 1/5 scale targets.

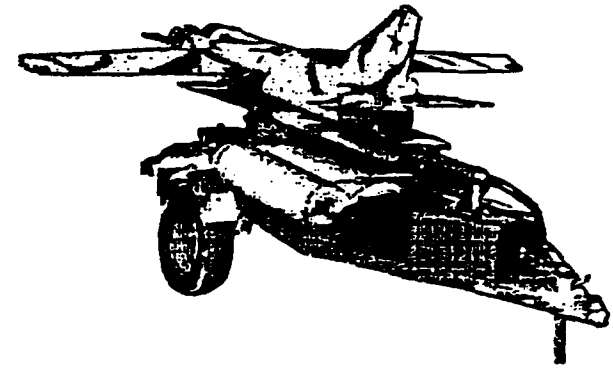
Inexperienced or untrained personnel should not attempt to perform FTS operations and maintenance, at risk of injury or death.

1.1 Functional Description

The FTS is comprised of flying fixed-wing and rotary-wing friendly and hostile aircraft capable of being controlled by radio from remote ground positions. The targets can be flown at distances of up to 3 kilometers from the pilot, at altitudes of up to 10,000 feet above sea level, at speeds of up to 100 mph, and for up to thirty minutes continuous duration. Aircraft are launched from a reliable, mobile, compressed air launcher system. Targets are radio frequency (RF) guided to remote locations using numerous precision hand-off maneuvers. Upon completion of a scenario, each aircraft is flown back to the launch location for landing.

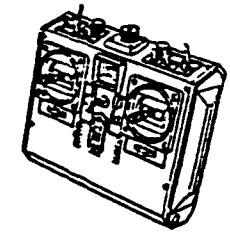


RF ANTENNA FOR AIRCRAFT CONTROL



LAUNCHER WITH FIXED WING MOUNTED

RADIO



TRANSMITTER FOR AIRCRAFT CONTROL

Figure 1.0-1. Flying target system.

Under the conditions of unimproved grassy or sandy areas normally found at training and firing ranges, the aircraft are easily recoverable with a minimum of structural damage. Excluding hits to the engine, fuel tank, electronics, and control mechanisms, the aircraft system can survive small arms hits up to 30 millimeters in size with minimal operational degradation.

1.2 Purpose

This manual describes FTS components and outlines procedures to include the following:

- Major components of the FTS
- Required items and spare parts needed to operate and maintain the FTS
- Description of operator controls and adjustments
- Procedures for initial acceptance to ensure accountability and operability
- Preflight preparation procedures
- Procedures for setting up and operating the FTS
- Matrix of required aircraft operational specifications

NOTE

Refer also to Appendix A for diagrams and descriptions of FTS equipment.

1.3 Safety

A number of safety precautions should be taken when working with or around FTS systems. The operator should be familiar with the warnings provided throughout this manual.

2.0 Major RTS Components

2.1 Aircraft

Aircraft model types available with the RTS in 1/5 scale are listed below (see Appendix A for more information). Other scales are also available but this manual covers only 1/5 scale.

- A-7 Corsair
- A-10 Thunderbolt
- F-16 Fighting Falcon
- MiG-27 Flogger
- Su-17/20/22 Fitter
- Su-25 Frogfoot
- Mi-24 Hind-D (autogyro)

NOTE

The autogyro is a winged helicopter with stabilizing rotor. It is launched and flown like a fixed-wing aircraft.

Retro-reflector pods (one for top mounting and two wing-tip pods per set) are essential components of aircraft in the RTS (see RTS Operations Manual).

The aircraft are capable of accommodating a 15 pound, 468 cubic in (typically 6.0 in. x 6.0 in. x 13.0 in.) payload of uniform density. The payload will not degrade performance characteristics and is carried internally in a payload compartment. The aircraft will provide a radar signature for the Vulcan Gun System. Missile systems such as the Stinger and Chaparral are stimulated by heat from the aircraft engines.

2.2 Aircraft Communications

Aircraft receivers, transmitters, antennas, coaxial cables, and tripod assemblies comprise the aircraft communications equipment. All transmitters must be on the same frequency as the aircraft receivers or loss of aircraft will result.

2.2.1 Receiver-Servo Group

The receiver-servo group is comprised of the receiver, servos, servo control parts, receiver wire extensions, switch harness assembly, battery pack, and antenna. It receives and converts the transmitted electronic pulses from the ground based transmitter into mechanical movements which control the aircraft throttle and flight control surfaces of the aircraft (e.g., aileron, elevator).

2.2.2 Transmitter Group

The transmitter is ground based, is operated by a pilot, and contains the throttle and flight controls for the aircraft. Control stick movements (pitch, roll, and throttle) are translated into electrical impulses that are transmitted to the aircraft via the RF link.

2.3 Voice Communications

Five hand-held, two-way radios, antenna cable assemblies, and headsets (optional) comprise the voice communications equipment. The launch site, control area, and mobile pilot teams require voice communications.

2.4 Mobile Launcher

The launcher assembly, 2 compressed air bottles (rated 2100 psi), 2 harpoon assemblies, a pair of wheel chocks, a 12V battery, and a 12V starter comprise the mobile launcher.

2.5 Ground Support Equipment

Ground support equipment (GSE) includes supplies which support the operation and maintenance of the aircraft, such as battery charging equipment, spare or replacement parts, and tools.

3.0 Spare Parts and Tools List

Refer to Appendix A for more information.

- Radio receiver and one spare, set to assigned frequency
  - Receiver wire extensions for aircraft: one 6 in., one 12 in., and one 36 in.
  - Receiver switch harness
- Three radio transmitters and one spare, set to assigned frequency
  - Coaxial cable assembly for launch transmitter, consisting of the following: 50 ft coaxial cable RG-8, connectors PL-259, and one adapter PL-259 BNC
  - Coaxial cable assembly for mobile team transmitters, consisting of the following: 10 feet coaxial cable RG-59, two connectors PL-259, and one connector BNC
- Servos: one FP-S34 (large); two FP-S30 (small)
  - Servo control arms (assorted sizes)
  - Servo control horns (1/4 in.)
  - Package of clevises (1/8 in.)
  - Package of servo screws
  - Push rod wire (1/8 in. music wire, threaded)
- Expanded scale voltmeter used for measuring receiver and transmitter battery voltages
- 12V DC battery and battery charger
- Aircraft fuel tanks (one quart capacity), including package of gas lines (3 ft long -- Blue Line) and two cable-wire ties per tank (15 in. long).

Do not use neoprene (glow-fuel) hose line; it may cause serious damage to equipment.

Flight time for an aircraft with a one quart fuel tank is approximately 20-30 minutes. Failure to monitor flight time may result in loss or destruction of aircraft.

- Aircraft fuel, gasoline can, and funnel

Use premium unleaded gasoline. Failure to do so will result in decreased engine life and fouled spark plugs.

Aircraft fuel is highly flammable.
Use only in a well ventilated area. Do not use near open flame.

Smoking is prohibited while handling fuel.

Have fire extinguisher in immediate area while handling fuel.

- Engine oil, two-cycle (brand name Castrol is preferred); one quart per 10 gallons of gasoline.

Using any type of motor oil other than two-cycle engine oil will cause serious damage to the engine.

- Balancing stand used for checking center of gravity of aircraft when installing required components and payloads.

- Mobile launcher assembly equipment including:

  - Two compressed air bottles (2100 psi)
  - Foot pedal air assembly used to launch aircraft
  - Two launch harpoons
  - Four piston cups (harpoon seal)
  - Rudder locking assembly to stabilize rudder during autogyro launching
  - Tail wheel assembly to ensure tail of autogyro maintains a horizontal plane to launcher surface during launch (disconnects at launch)
  - Nylon shear bolts (50 1/4 x 1 in., 20 thread) which hold launcher harpoon in launch tube and holds aircraft on launcher prior to launch
  - Rotor blade pre-spin for autogyro
  - Compressed air bottle fitting wrench
  - Starter (12V DC) for starting aircraft
  - Battery (12V DC) for starter
  - Fire extinguisher

CAUTION

Amount of air needed is determined by number of scheduled launches and aircraft model and scale types. Approximately 50 launches are provided per air bottle. If main air gauge reads 400 psi, change to spare bottle. Launching an aircraft with less than 400 psi may damage it.

NOTE

Harpoon seals will last approximately 50 launches.

Launching over asphalt or gravel surfaces deteriorates piston cups rapidly.

- Retro-reflectors
  - Top pod (a group of 5 retro-reflectors configured to be easily mounted to or dismounted from top of fuselage)
  - Wingtip pod on each wingtip (a group of 3 retro-reflectors configured to be easily mounted to or dismounted from wingtips of aircraft)
- Ground Support Equipment
  - Adhesives: Epoxy, 5 minute set-up time; Super Glue (4 oz); Zip Kicker (2 oz spray bottle and 8 oz refill bottle; LocoTite (1 oz); duct tape
  - Fiberglass repair kit including fiberglass material, resin, hardener, mixing pan, and scissors
  - Fasteners: five propeller nuts; ten tee-nuts (1/4 in., 20 thread)
  - Miscellaneous hardware: one package of assorted washers, one package of assorted hex bolts (1/4 in., 20 thread; 2 to 5 in.); two spinners; ten skid pads
- Propellers (amount on hand determined by number of flights programmed, at a rate of one per launch)

CAUTION

If propeller contains split ends, cracks or other damage, replace immediately.

- Tools and supplies
  - Sandpaper (coarse, medium, and fine)
  - Hexagonal Allen wrenches (3/16, 5/32, 9/64, and 1/8 in.)
  - Wrenches, box and open-ended (1/2, 7/16, and 9/16 in.)
  - Adjustable wrench
  - Nut drivers (1/2, 7/16, and 3/8 in.)
  - Screwdrivers (Phillips #0 and #2)
  - Screwdrivers (flat-head 1/8 and 1/4 in.)
  - Slip-joint pliers
  - Long-nose pliers
- First aid kit

Always use hearing protection when working near running aircraft engines.

Failure to do so may result in hearing loss.

4.0 Description of Operator Controls and Indicators

4.1 Aircraft Controls and Indicators

The controls and indicators of the aircraft are described below.

Table 4.1-1

Aircraft Controls and Indicators

Control or Indicator	Function
Receiver-Servo Group	Controls the aircraft via the Ground Transmitter
Flight Stablization Unit	Stablizes the aircraft in flight
Ailerons	Two wing flaps used to control the aircraft's rolling and banking movements
Elevator	A movable control surface used to produce up or down motion in the aircraft
Engine	Converts energy into mechanical motion

4.2 Receiver-Servo Group Controls and Indicators

The controls and indicators of the receiver-servo group are described below.

Table 4.2-1

Receiver-Servo Group Controls and Indicators

Control or Indicator	Function
Receiver-Servo Power Switch	Applies power to the receiver-servo group
Elevator Servo	Controls movement of the elevator (pitch)
Aileron Servo	Controls movement of the ailerons (roll)
Throttle Servo	Opens and closes the engine carburetor air intake valve
Receiver-Servo Receptacle	Access for battery voltage check and charging
Receiver-Servo Receptacle	Access for battery voltage check and charging

4.3 Transmitter Controls and Indicators

The controls and indicators of the transmitter are listed and illustrated in Figure 4.3-1 and described below.

Table 4.3-1

Transmitter Controls and Indicators

Control or Indicator	Function
Aileron Stick	Controls the ailerons (roll)
Elevator Stick	Controls the elevators (pitch)
Throttle Stick	Controls the throttle
Rudder Stick	Controls the rudder
Aileron Trim Lever	Aileron trimmer
Elevator Trim Lever	Elevator trimmer
Throttle Trim Lever	Throttle trimmer
Rudder Trim Lever	Rudder trimmer
Power Switch	Applies power to transmitter
Volt Meter	Provides indication of battery charge level

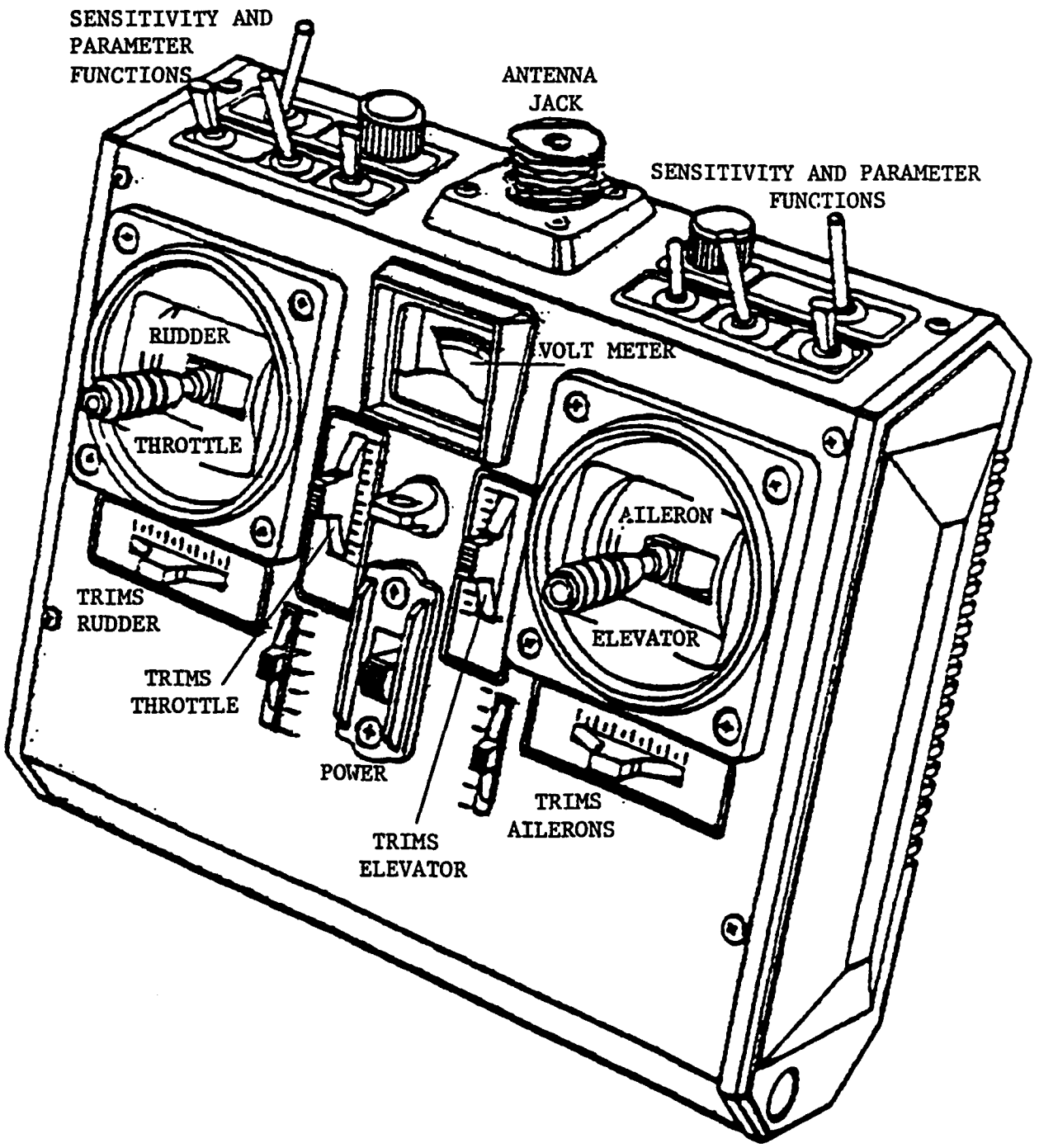


Figure 4.3-1. Transmitter controls and indicators.

5.0 Aircraft Support Equipment Unloading, Assembly, and Check-out Procedures

The following procedures are used for initial receipt of equipment and should not be confused with Aircraft Set-up and Operations Procedures, Section 7.0. Before proceeding, an inventory should be performed using Section 3.0, Spare Parts and Tools List, as a guide.

5.1 Ground Support Equipment (GSE) Unloading

1. Unload GSE box.

2. Obtain tools required for aircraft assembly operations.

5.2 Aircraft Assembly

1. Unload aircraft fuselages, wings, and tail-sections.

Receiver and receiver-servo group batteries are shipped with a foam pad secured around them. Do not remove the foam pad material from around the receiver or the battery. Foam pads protect components and airframe compartment from damage during flight. It may be necessary to add additional foam padding.

Do not force push rods to move or damage to servo gears can result.

2. Assemble the tail section.

   - Collocate appropriate tail-sections with the appropriate fuselages
   - Before securing tail-section, mate servo electrical wires (male to female) and tape connections
   - Secure with 1/4 in, 20 thread hex-head bolts

3. Unload chargers and transmitters.

   - Connect charger wires to battery packs: use receive (RX) side of charger for aircraft receiver battery packs and transfer (TX) side of charger for the transmitter battery packs
   - Receiver batteries should read 5.5V DC or better and transmitter batteries should read 11V DC or better as measured with the expanded scale voltmeter

- Recharge batteries if voltage is inadequate

Do not charge Nicad battery packs in excess of 48 hours or damage will result.

5.3 Communications (Aircraft and Voice) Set-Up

1. Unload transmitter antenna, coaxial cable, and tripod assembly; assemble them.

2. Unload voice communications equipment.

   - Charge batteries for a minimum of 12 hours on the hand-held transceivers
   - Assemble two-way radios and antenna, coaxial cable, and tripod assemblies
   - Make communications check with other radios to ensure operability

5.4 Mobile Launcher Assembly

1. Unload mobile aircraft launcher.

2. Obtain the fuel can.

Ensure a fire extinguisher is in the immediate vicinity.

The fuel is flammable. Use only in a well-ventilated area. Extinguish all flames and do not smoke while handling fuel.

3. Mix 1/2 quart of oil (two-cycle) with five gallons of premium unleaded gasoline. Amount supports approximately twenty (20) flights.

4. Fill the fuel tank on the launcher.

Ensure the fuel cap is not left off any longer than necessary during fueling operations to prevent fuel evaporation or contamination.

5. Service and charge the launcher automotive battery to a minimum of 12V DC.

The 12V acid battery is shipped without necessary electrolyte. Electrolyte is a sulfuric acid solution which can cause severe burns and is highly corrosive. Avoid contact with skin, eyes, and clothing. If contact with skin or eyes occurs, flush with water and seek medical attention immediately.

Lead-acid batteries release a flammable explosive gas during charging. Remove battery vent seal and install battery vent tubing to allow gas to escape. This will prevent an increase of internal gas pressure to the point of pressure-induced explosion. Charging should be performed in an open, well-ventilated area. Do not smoke or allow open flames in vicinity during charging operations. Batteries may explode if charged or discharged too rapidly.

Observe polarity when connecting battery charger leads to battery, voltmeter leads to battery, and battery to equipment.

Connect voltmeter to battery just long enough to check for proper voltage level. Voltmeter can be damaged by heat generated within its internal battery.

6. Ensure main air regulator valve is turned fully counter-clockwise and that the compressed air bottle valve is turned fully clockwise.

7. Connect the regulator input air hose to the compressed air bottle and tighten bottle connector collar with fitting wrench.

8. Open compressed air bottle valve fully counter-clockwise.

9. Read main air pressure gauge. It should read at least 1000 psi (depending on model type, enough for 6 to 8 launches for 1/5 scale targets) -- see Section 8.0, Aircraft Operation Specifications.

NOTE

Compressed air bottles should read 2100 psi when fully charged.

10. Close compressed air bottle valve fully by turning clockwise.

Exercise extreme care when handling compressed air bottles.

Before storing or handling the compressed air bottle, ensure that the valve is turned fully clockwise (closed).

Failure to do so could result in injury to personnel.

11. Check launcher harpoon box for the following:

- Two harpoons
- Four harpoon seals (piston cups)
- Nylon shear bolts (full box) should be on hand, one per launch
- DC starter motor with color-coded cable harness (starts the aircraft engine)

6.0 Preflight Preparation Procedures

6.1 Aircraft Check-Out Procedures

1. Obtain a list of aircraft type and number to be flown from Mission-Test Director.

2. Obtain aircraft from storage.

3. Check propeller, prop-nut, spinner, and drive shaft for defects and tightness, including any drive shaft extension collars. Replace and tighten as necessary.

If propeller contains any split ends, cracks, or other damage (no matter how slight), replace it.

4. Install propeller horizontally to decrease possibility of damage. Refer to Section 8.0, Aircraft Operation Specifications, for correct propeller assignment.

5. Check engine mount and engine for defects and loose hardware. Replace and secure as necessary.

6. Check fuel lines and gas tanks for cracks, leaks, corrosion, and residue. Clean and replace as necessary.

7. Check aircraft receiver gear, interconnecting wiring, cables, and plug-ends for defects and chaffing. Repair or replace as necessary.

8. Check aircraft control surfaces and servos for bad gears, loose screws, broken servo arms, and control horns. Repair, tighten, or replace as necessary.

9. Perform electrical checks of control surfaces and servos.

- Turn transmitter and aircraft receiver on and check movement of control surfaces and all servos (throttle, elevator, ailerons, and flaps if so equipped) while manipulating controls on transmitter
- If not at proper throw and adjustment, adjust servo arms and push rods as necessary
- Ensure switches are turned off at completion of check

10. Perform airframe inspection.

- From front to rear of aircraft, inspect fuselage for cracks and separations in fiberglass; repair as necessary
- Inspect wing and tail assemblies for cracks and separations of fiberglass and loose or broken hinges; repair as necessary

NOTE

Any area needing new fiber glass must be free of paint and grease before repair.

- Check skid-pads for wear and adhesion; repair or replace as necessary
- Check for broken or loose retro-reflector pod mounts; repair as necessary
- Check center of gravity of aircraft (see Section 8.0, Aircraft Operation Specifications); adjust and secure payload as necessary

6.2 Batteries Check-Out

1. Aircraft receiver batteries must be charged for a minimum of 12 hours. Use the voltmeter to ensure batteries are fully charged to 5.5V DC.

CAUTION

Aircraft receiver batteries must not be on a charger longer than 48 hours or damage to batteries may result.

2. Voice radio batteries must be charged overnight. Check batteries by attempting voice contact with remote locations.

6.3 Ground Support Equipment Check-Out

1. Ensure the GSE box is complete (refer to parts list in Section 2.5).

2. Ensure required tools and test equipment are on-hand to perform aircraft and launcher maintenance (refer to Section 3.0).

3. Ensure first aid kit and fire extinguisher are on hand at all times in immediate vicinity of work area.

6.4 Mobile Launcher Assembly Check-Out

1. Perform maintenance and service checks on the following items to ensure operational readiness:

   - Compressed air--check in accordance with Section 5.4
   - 12V battery charge--check for 12V DC (observe proper polarity)
   - Launch harpoons--check for serviceability
   - Nylon shear-bolts--ensure a minimum of 50 on hand

2. Ensure launcher fuel tank is full of pre-mixed fuel.

7.0 Aircraft Set-Up and Operations Procedures

7.1 Equipment Loading

1. Load aircraft fuselages and wing assemblies on launch crew transportation.

2. Load GSE box on launch crew transportation.

NOTE

Transportation must have a 1 7/8 in. ball trailer hitch for towing mobile launcher assembly.

3. Load voice radio transmitters, antennas, and cables in appropriate transport cases. Ensure radios, headsets, etc. have been checked out before deployment. Ensure antenna and coaxial cable assemblies have been checked out as well.

4. Load appropriate equipment transport cases on mobile team transportation.

5. Load mobile launcher assembly

- Check launcher for serviceability. Refer to Section 6.0, Preflight Preparation Procedures
- Attach the launcher to the 1 7/8 in. ball hitch on the launch crew transportation towing bracket

7.2 Pilot Deployment and Site Set-Up

1. Deploy mobile launcher trailer, GSE box, radio equipment, and launch crew to launch site.

2. Deploy mobile control teams to predesignated remote positions.

3. Unload and set-up aircraft transmitter antenna and coaxial cable assemblies at each pilot position (launch and mobile).

4. Unload and set-up voice communications equipment.

5. Re-establish communications among all aircraft pilots and Range Control System (RCS) operator.

6. Launch site set-up procedures:

- Unload aircraft fuselages and place them in order to be flown
- Unload wing assemblies and place them alongside appropriate fuselages
- Connect aileron (and optional flap) wire connections between fuselage and wing assembly. Attach wing to fuselage for each aircraft
- Secure wing assemblies to fuselages with 1/4 in., 20 thread wing bolts (normally resident on fuselage)
- Unload GSE box
- On aircraft fuselage, turn power switch on receiver to ON; perform this step consecutively, one aircraft at a time
- Energize aircraft transmitter
- Recheck aircraft control surfaces and transmitter-receiver responses (throttle, elevator, and ailerons)
- After each aircraft has been checked, ensure that aircraft power switch has been turned OFF

NOTE

Practicing of all flight paths, determining terrain feature orientation, and selection of pilot positions should be performed prior to scheduled exercise.

7.3 Mobile Launcher Assembly Set-Up Procedures

1. Point launcher into the wind and set wheel chocks.

2. Remove foot pedal air assembly and place behind launcher.

3. Obtain large air exit hose and secure it to foot pedal air assembly.

4. Obtain aircraft starter motor and secure color coded cable harness leads to 12V battery on launcher.

Rotation of starter motor is polarity-dependent and cable harness leads can be connected incorrectly if polarity is not observed. After connecting leads, depress the starter switch and observe that starter is rotating in a counter-clockwise direction when held facing the prop spinner.

5. Obtain harpoon and insert it into launch tube on the launcher.

6. Secure the harpoon by inserting a nylon 1/4 x 1 in., 20 thread shear bolt into hole in side of launch tube.

7. Attach main air hose to air regulator unit and attach an air-chuck at other end.

8. Open compressed air bottle valve counter-clockwise and adjust main air regulator valve to 50 psi.

9. With air-chuck, fill the launcher fuel tank with air to 4-5 psi.

10. With fuel tank hose, fill aircraft with fuel until fuel flows out of overflow-breather tubes.

11. Disconnect air-chuck from main air hose.

12. After ensuring foot pedal air assembly valve is turned off, connect main air hose to foot pedal air assembly.

13. Mount retro-reflector pods to wingtips and to top of fuselage.

Ensure area in front of launcher is clear of personnel, in the event of premature launch.

14. Place aircraft to be launched on launcher, ensuring harpoon tongue is inserted into slotted launch plate on underside of aircraft.

15. Adjust the launcher's wing stabilizer wheel assemblies underneath each wing to obtain a level wing indication.

16. Adjust main air regulator valve for 500 psi on gauge.

7.4 Launch and Landing Operations Procedures

Flight time for an aircraft with a one quart fuel tank is approximately 20 minutes. Failure to monitor the flight time may result in the loss or destruction of the aircraft.

Ensure fire extinguisher is in close proximity of the mobile launcher.

It is extremely hazardous to attempt to launch or fly aircraft when winds exceed 25 knots (29 mph).

1. Verbally transmit aircraft reversing switch positions to all pilot teams and await an acknowledgement.

NOTE

Aircraft transmitter reversing switch settings are determined according to aircraft.

2. Contact RCS operator and transmit "ready and standing by." Await acknowledgement.

3. Launch the aircraft when RCS operator transmits "launch the aircraft." Ensure aircraft is facing into the wind before launching.

- Turn launch transmitter switch on and then turn on the aircraft receiver
- Start aircraft engine with 12V DC starter motor

Never launch or fly the aircraft in the direction of other personnel, buildings, structures, or vehicles.

Only the launch crew should be in the vicinity of the launcher, the one who starts the aircraft engine and the one who holds the rear of the aircraft for stabilization.
The propeller and the area adjacent to each side of the propeller is a danger zone when engine is running.

Ensure starter personnel have no loose clothing that may get entangled in the propeller.

- Fill air bottle using valve handle on foot pedal air assembly with compressed air to correct pressure; see Section 8.0, Aircraft Operation Specifications for correct psi for type of aircraft

Failure to use prescribed launch air pressure (too much or too little) may result in destruction of aircraft.

Do not start the aircraft engine if the drive shaft is bent or binding.

- On launch pilot transmitter, go to full throttle
- With launch pilot transmitter controls, recheck aircraft control surfaces
- Carefully watching the aircraft, launch aircraft by depressing foot pedal
- Record time of aircraft launch

4. After aircraft is airborne, set aircraft trims and verbally transmit trim settings to mobile aircraft pilots. Await acknowledgement.

5. After aircraft has landed, retrieve it and inspect it for defects. Record information, to include flight time, on Daily Flight Log as well as individual aircraft's flight log.

Landing requires practice. Never land aircraft while the engine is running; propeller and airframe damage may result.

Do not turn the propeller if any dirt is visible in carburetor intake or exhaust port.

6. Retrieve harpoon and inspect seal (piston cup) for serviceability. Replace if necessary.

Aircraft engine and muffler will be hot.

Handle with caution.

Failure to do so could result in injury to personnel.

7.5 Radio Procedures for Aircraft Hand-Offs

1. Upon receiving message from RCS operator verifying reliable position-location tracking, commence run to mobile pilot by announcing, "commencing run to mobile (one, two etc.)." Await an acknowledgement.

2. Upon visual contact of aircraft, the mobile pilot will announce, "visual 3, 2, 1 switch."

3. At this point, launch pilot will turn transmitter off and mobile pilot will turn transmitter on. Mobile pilot announces, "have control." Launch pilot acknowledges this.

4. Announce "switch-back" if control is not sufficiently obtained after a hand-off. Pilot making the announcement immediately turns transmitter off and hand-off pilot immediately turns transmitter back on. The aircraft will then be flown back to present pilot's location to orbit and to await further instructions.

5. After transmitting "have control," pilot will fly aircraft according to prescribed flight path toward the observer-weapon location.

6. Repeat steps 1 to 3 for all hand-offs.

8.0 Aircraft Operational Specifications

RTS 1/5 scale aircraft represent and are flown like their full-scale counterparts, thereby appearing like the "real thing" to the air defense crewmen on the ground. Ingressing, ingressing-crossing, and crossing flight patterns, and pop-up and lay-down maneuvers can be executed with high accuracy. Aircraft are flown at a speed of about 160-200 km per hour (100-125 mph; 88-110 knots), approximating a full-scale equivalent speed of Mach one. Specifications for each aircraft are provided in Table 8.0-1.

Table 8.0-1

Aircraft Operational Specifications

MODEL	PROP SIZE	CENTER OF GRAVITY	LAUNCH PSI (0 to 70 deg)	LAUNCH PSI (> 71 deg)	Has Wing Flaps	Has Drive Shaft
A-7	20" 8-14	17" *	300	375	YES	NO
A-10	20" 8-14 (2 Eng.)	17 1/2" *	480	510	NO	NO
F-16	20" 8-14	21 1/4" *	375	400	YES	YES
MiG-27	20" 8-14	14 1/2" *	300	375	YES	NO
Su-17	20" 8-14	18 5/8" *	450	500	YES	NO
Su-25	20" 8-14	15 1/4" *	300	375	NO	NO
Mi-24	20" 8-14	1 3/4" **	200	250	NO	NO

* Measured from trailing edge

** Measured from leading edge

NOTE

PSI Specifications are based on an elevation of 4,200 " above sea level

9.0 References

Department of the Army Headquarters (1986). Radio Controlled Miniature Aerial Target (RCMAT) operations and maintenance reference manual (TM 9-1550-417-14&P). Washington, DC: Headquarters Department of the Army.

APPENDIX A: SCALED TARGET SPECIFICATIONS

SPECIFICATIONS	C15A7G	C17A7G	C19A7G
SCALE	1/5	1/7	1/9
SPAN	99 in.	67 in.	52 in.
WEIGHT	42 lbs	27 lbs	10 lbs
FUEL	GAS/OIL	GAS/OIL	NITRO-METHANOL
TANK CAPACITY	32 oz (std)	32 oz (std)	16 oz (std)
ENDURANCE AT MAX SPEED	30 min	30 min	16 min
SPEED	35-110 MPH	40-95 MPH	15-75 MPH
PAYLOAD	20 lbs	15 lbs	5 lbs
CONTROL RANGE	15 km	3 km	2 km

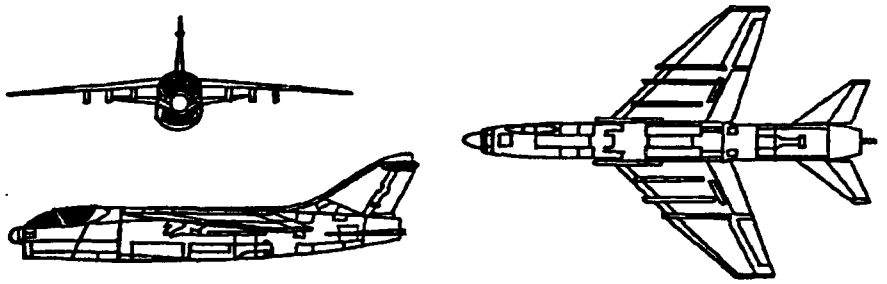


Figure A-1. A-7 Corsair.

SPECIFICATIONS	C15A10G	C17A10G	C19A10G
SCALE	1/5	1/7	1/9
SPAN	135 in.	100 in.	75 in.
WEIGHT	60 lbs	26 lbs	13 lbs
FUEL	GAS/OIL	GAS/OIL	NITRO-METHANOL
TANK CAPACITY	64 oz (std)	32 oz (std)	16 oz (std)
ENDURANCE AT MAX SPEED	30 min.	30 min	16 min
SPEED	25-117 MPH	30-110 MPH	15-90 MPH
PAYLOAD	30 lbs	20 lbs	6 lbs
CONTROL RANGE	15 km	3 km	2 km

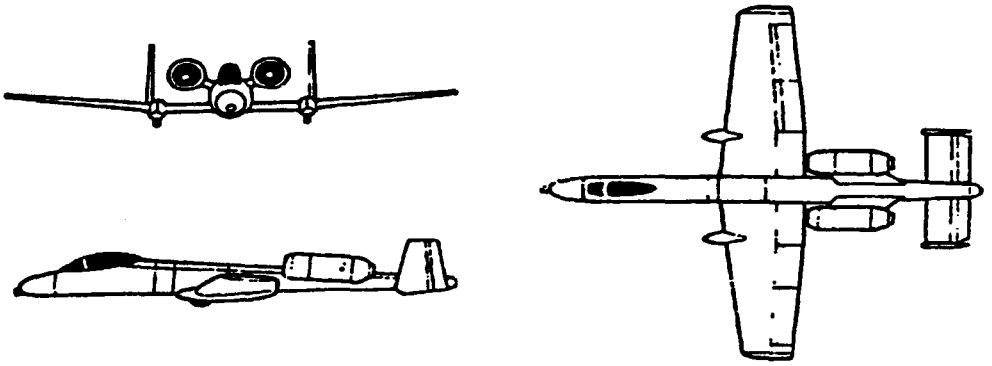


Figure A-2. A-10 Thunderbolt.

SPECIFICATIONS	C15F16G	C17F16G	C19F16G
SCALE	1/5	1/7	1/9
SPAN	82 in.	60 in.	48 in.
WEIGHT	45 lbs	37 lbs	11 lbs
FUEL	GAS/OIL	GAS/OIL	NITRO-METHANOL
TANK CAPACITY	32 oz (std)	32 oz (std)	16 oz (std)
ENDURANCE AT MAX SPEED	30 min	30 min	16 min
SPEED	44-109 MPH	45-100 MPH	25-85 MPH
PAYLOAD	25 lbs	15 lbs	5 lbs
CONTROL RANGE	15 km	3 km	2 km

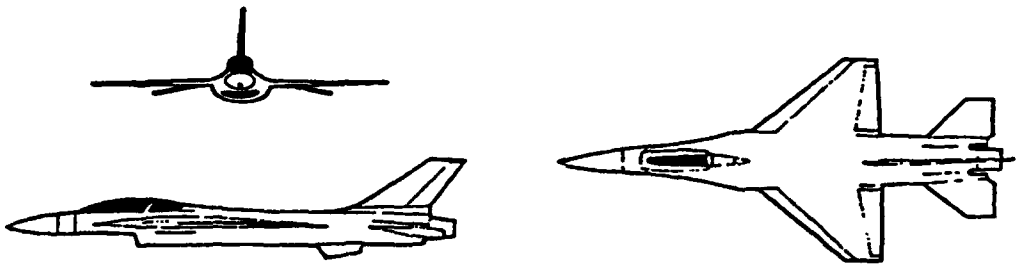


Figure A-3. F-16 Falcon.

SPECIFICATIONS	C15F111G	C17F111G	C19F111G
SCALE	1/5	1/7	1/9
SPAN	151 in.	108 in.	84 in.
WEIGHT	65 lbs	44 lbs	30 lbs
FUEL	GAS/OIL	GAS/OIL	NITRO-METHANOL
TANK CAPACITY	32 oz (std)	32 oz (std)	16 oz (std)
ENDURANCE AT MAX SPEED	30 min	30 min	12 min
SPEED	35-110 MPH	40-95 MPH	15-75 MPH
PAYLOAD	20 lbs	15 lbs	5 lbs
CONTROL RANGE	15 km	3 km	2 km

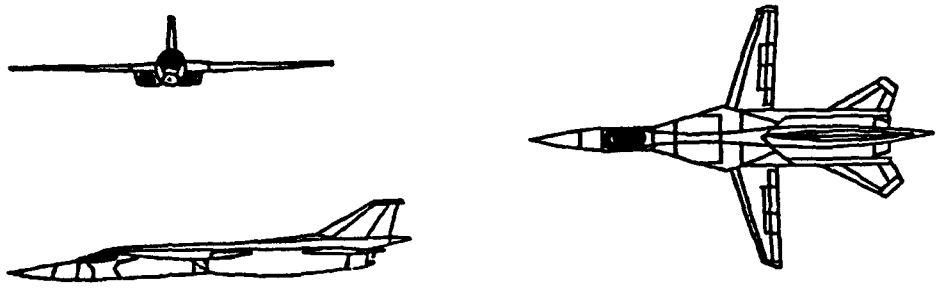


Figure A-4. F-111 Aardvark.

SPECIFICATIONS	C15SU24G	C17SU24G	C19SU24G
SCALE	1/5	1/7	1/9
SPAN	141 in.	96 in.	75 in.
WEIGHT	47 lbs	38 lbs	11 lbs
FUEL	GAS/OIL	GAS/OIL	NITRO-METHANOL
TANK CAPACITY	32 oz (std)	32 oz (std)	16 oz (std)
ENDURANCE AT MAX SPEED	30 min	30 min	14 min
SPEED	35-110 MPH	40-95 MPH	15-75 MPH
PAYLOAD	20 lbs	15 lbs	5 lbs
CONTROL RANGE	15 km	3 km	2 km

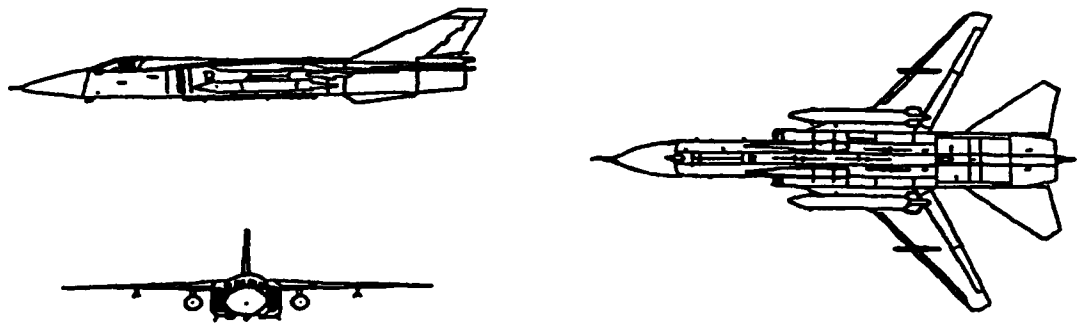


Figure A-5. Su-24 Fencer.

SPECIFICATIONS	C15SU25G	C17SU25G	C19SU25G
SCALE	1/5	1/7	1/9
SPAN	126 in.	100 in.	75 in.
WEIGHT	41 lbs	32 lbs	12 lbs
FUEL	GAS/OIL	GAS/OIL	NITRO-METHANOL
TANK CAPACITY	32 oz (std)	32 oz (std)	16 oz (std)
ENDURANCE AT MAX SPEED	30 min	30 min	16 min
SPEED	40-101 MPH	35-100 MPH	15-90 MPH
PAYLOAD	25 lbs	20 lbs	6 lbs
CONTROL RANGE	15 km	3 km	2 km

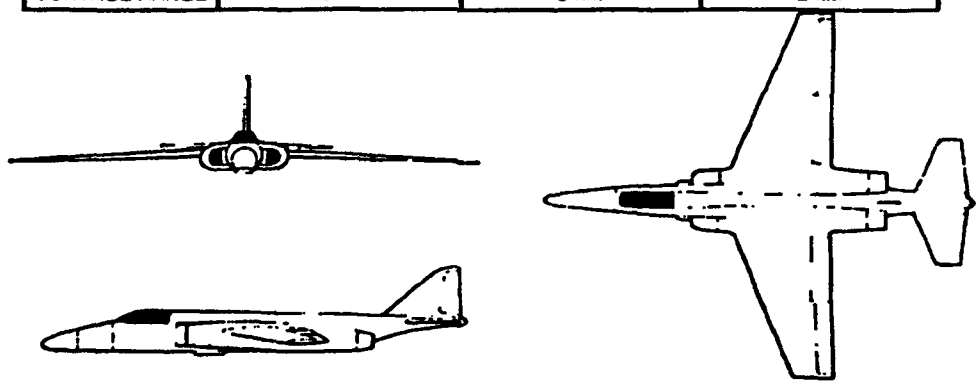


Figure A-6. Su-25 Frogfoot.

SPECIFICATIONS	C15SU17G	C17SU17G	C19SU17G
SCALE	1/5	1/7	1/9
SPAN	116 in.	78 in.	66 in.
WEIGHT	43 lbs	30 lbs	12 lbs
FUEL	GAS/OIL	GAS/OIL	NITRO-METHANOL
TANK CAPACITY	32 oz (std)	32 oz (std)	16 oz (std)
ENDURANCE AT MAX SPEED	30 min	30 min	12 min
SPEED	22-110 MPH	25-115 MPH	15-90 MPH
PAYLOAD	25 lbs	16 lbs	5 lbs
CONTROL RANGE	15 km	3 km	2 km

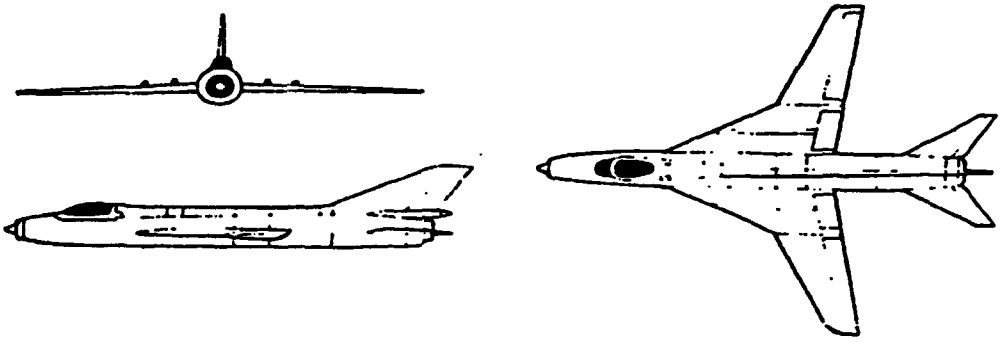


Figure A-7. Su-17 Fitter.

SPECIFICATIONS	C15M27G	C17M27G	C19M27G
SCALE	1/5	1/7	1/9
SPAN	118 in.	100 in.	60 in.
WEIGHT	42 lbs	29 lbs	11 lbs
FUEL	GAS/OIL	GAS/OIL	NITRO-METHANOL
TANK CAPACITY	32 oz (std)	32 oz (std)	16 oz (std)
ENDURANCE AT MAX SPEED	30 min	30 min	16 min
SPEED	20-130 MPH	30-100 MPH	18-94 MPH
PAYLOAD	30 lbs	18 lbs	5 lbs
CONTROL RANGE	15 km	3 km	2 km

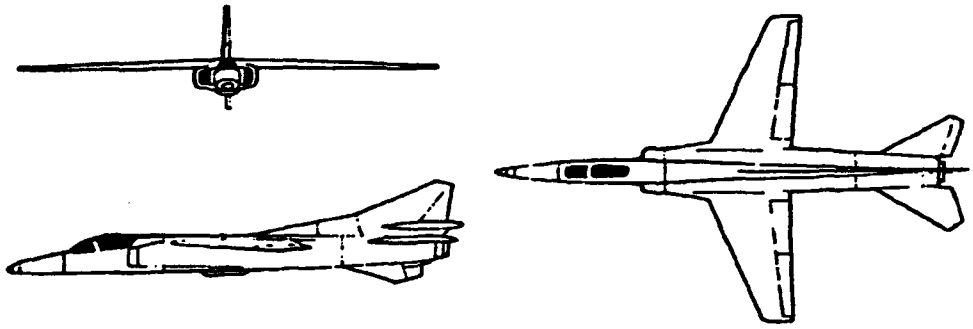


Figure A-8. MiG-27 Flogger.

SPECIFICATIONS C15M24GYG			
SCALE	1/5	ROTOR DIA.	120 in.
WEIGHT	40 lbs.	LENGTH	133 in.
FUEL	GAS/OIL	WING SPAN	70 in.
TANK CAPACITY	32 oz. std.	PAYLOAD	20 lbs.
ENDURANCE	30 min. std.		
FORWARD SPEED	80 MPH		

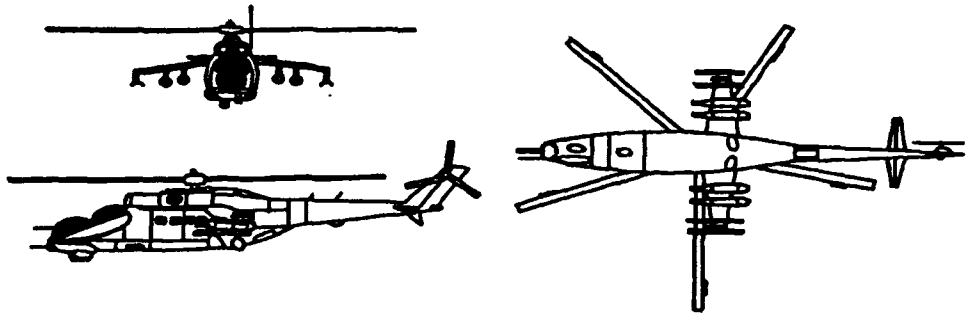


Figure 9. Mi-24 Hind-D.